

CLAIMS

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1. ~~A display apparatus for performing gray scale display by dividing one field of picture into a plurality of weighted subfields and by controlling each subfield to emit or not emit based on the gray scale level of pixel in the picture, said apparatus comprising:~~

10 ~~a conversion unit for selectively converting a gray scale level of the pixel to one gray scale level in a first gray scale group or one gray scale level in a second gray scale group, said first gray scale group including a plurality of gray scale levels to be used for actual display, the gray scale level in the first gray scale group being expressed by the combination of the subfields, said second gray scale group including a plurality of gray scale levels each of which is in the middle of the gray scale levels in the first gray scale group; and~~

15 ~~a first diffusion unit for generating video signal, said video signal displaying a gray scale level obtained by the conversion unit when the gray scale level obtained by the conversion unit is in the first gray scale group, or a gray scale level in the first gray scale group which is obtained by diffusing a predetermined value corresponding to the gray scale level in the second gray scale group when the gray scale level obtained by the conversion unit is in the second gray scale group.~~

2. ~~The apparatus according to claim 1, wherein the first gray scale group includes gray scale levels each of which is achieved by subfields in which there is no non-emitting subfields in subfields having weights less than the greatest weight among weights of the subfields to be emitted for achieving the gray scale level.~~

3. The apparatus according to claim 1, wherein the first gray scale group includes gray scale levels each of which is achieved by subfields in which there is at most one of non-emitting subfields in subfields having weights less than the greatest weight among weights of the subfields to be emitted for achieving the gray scale level.

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4. The apparatus according to claim 1, wherein the first gray scale group includes gray scale levels each of which is achieved by subfields in which there is at most two of non-emitting subfields in subfields having weights less than the greatest weight among weights of the subfields to be emitted for achieving the gray scale level.

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5. The apparatus according to claim2, wherein said non-emitting subfield excludes a subfield having the minimum weight.

6. The apparatus according to claim3, wherein said non-emitting subfield excludes a subfield having the minimum weight.

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7. The apparatus according to claim4, wherein said non-emitting subfield excludes a subfield having the minimum weight.

8. The apparatus according to claim2, wherein said non-emitting subfield excludes a subfield having the minimum weight and a subfield having the next succeeding minimum weight.

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9. The apparatus according to claim3, wherein said non-emitting subfield excludes a subfield having the minimum weight and a subfield having the next succeeding minimum weight.

10. The apparatus according to claim4, wherein said non-emitting subfield excludes a subfield having the minimum weight and a subfield having the next succeeding minimum weight.

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11. The apparatus according to claim 2, wherein said non-emitting subfield excludes a subfield having the minimum weight, a subfield having the next succeeding minimum weight and a subfield having the third succeeding minimum weight.

5 12. The apparatus according to claim 3, wherein said non-emitting subfield excludes a subfield having the minimum weight, a subfield having the next succeeding minimum weight and a subfield having the third succeeding minimum weight.

10 13. The apparatus according to claim 4, wherein said non-emitting subfield excludes a subfield having the minimum weight, a subfield having the next succeeding minimum weight and a subfield having the third succeeding minimum weight.

15 14. The apparatus according to claim 1, wherein the first diffusion unit generates the video signal to display the gray scale level in the first gray scale group which is obtained by adding or subtracting the value corresponding to the gray scale to be displayed to or from the gray scale level in the second gray scale group when the converted gray scale level from the gray scale conversion unit is in the second gray scale group.

20 15. The apparatus according to claim 1, further comprising a second diffusion unit for diffusing a difference between the gray scale level of pixel to be displayed and the converted gray scale level to pixels adjacent to the pixel to be displayed with predetermined ratio.

25 16. The apparatus according to claim 15, wherein the second diffusion unit determines a value to be diffused in horizontal direction based on a lower bits of all bits which indicate the gray scale level of pixel to be displayed, and a value

to be diffused in vertical direction based on a value obtained by removing the lower bits from a difference between the gray scale level of the pixel to be displayed and the converted gray scale level.

17. A display method for performing gray scale display by dividing one field
5 of picture into a plurality of weighted subfields and by controlling each subfield
to emit or not emit based on the gray scale level of pixel in the picture, said
method comprising:

selectively converting a gray scale level of the pixel to one gray scale level in a first gray scale group or one gray scale level in a second gray scale group, said first gray scale group including a plurality of gray scale levels to be used for actual display, the gray scale level in the first gray scale group being expressed by the combination of the subfields, said second gray scale group including a plurality of gray scale levels each of which is in the middle of the gray scale levels in the first gray scale group; and

15 generating video signal, said video signal displaying a gray scale level
obtained by the conversion when the gray scale level obtained by the
conversion is in the first gray scale group, or a gray scale level in the first gray
scale group which is obtained by diffusing a predetermined value corresponding
to the gray scale level in the second gray scale group when the gray scale level
20 obtained by the conversion is in the second gray scale group.

18. The method according to claim 17, wherein the first gray scale group includes gray scale levels each of which is achieved by subfields in which there is no non-emitting subfields in subfields having weights less than the greatest weight among weights of the subfields to be emitted for achieving the gray scale level.

19. The method according to claim 17, wherein the first gray scale group includes gray scale levels each of which is achieved by subfields in which there is at most one of non-emitting subfields in subfields having weights less than the greatest weight among weights of the subfields to be emitted for achieving 5 the gray scale level.

20. The method according to claim 17, wherein the first gray scale group includes gray scale levels each of which is achieved by subfields in which there is at most two of non-emitting subfields in subfields having weights less than the greatest weight among weights of the subfields to be emitted for achieving the 10 gray scale level.

21. The method according to claim 18, wherein said non-emitting subfield excludes a subfield having the minimum weight.

22. The method according to claim 19, wherein said non-emitting subfield excludes a subfield having the minimum weight.

15 23. The method according to claim 20, wherein said non-emitting subfield excludes a subfield having the minimum weight.

24. The method according to claim 18, wherein said non-emitting subfield excludes a subfield having the minimum weight and a subfield having the next succeeding minimum weight.

20 25. The method according to claim 19, wherein said non-emitting subfield excludes a subfield having the minimum weight and a subfield having the next succeeding minimum weight.

26. The method according to claim 20, wherein said non-emitting subfield excludes a subfield having the minimum weight and a subfield having the next 25 succeeding minimum weight.

27. The method according to claim 18, wherein said non-emitting subfield excludes a subfield having the minimum weight, a subfield having the next succeeding minimum weight and a subfield having the third succeeding minimum weight.

5 28. The method according to claim 19, wherein said non-emitting subfield excludes a subfield having the minimum weight, a subfield having the next succeeding minimum weight and a subfield having the third succeeding minimum weight.

10 29. The method according to claim 20, wherein said non-emitting subfield excludes a subfield having the minimum weight, a subfield having the next succeeding minimum weight and a subfield having the third succeeding minimum weight.

15 30. The method according to claim 17, wherein the first diffusion unit generates the video signal to display the gray scale level in the first gray scale group which is obtained by adding or subtracting the value corresponding to the gray scale to be displayed to or from the gray scale level in the second gray scale group when the converted gray scale level from the gray scale conversion is in the second gray scale group.

20 31. The method according to claim 17, further comprising diffusing a difference between the gray scale level of pixel to be displayed and the converted gray scale level to pixels adjacent to the pixel to be displayed with predetermined ratio.

25 32. The method according to claim 31, wherein the second diffusion unit determines a value to be diffused in horizontal direction based on a lower bits of all bits which indicate the gray scale level of pixel to be displayed, and a value

to be diffused in vertical direction based on a value obtained by removing the lower bits from a difference between the gray scale level of the pixel to be displayed and the converted gray scale level.